

(19)日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開平8-261958

(43)公開日 平成8年(1996)10月11日

(51)Int.Cl.⁸
G 0 1 N 23/04
B 6 1 B 13/00

識別記号 庁内整理番号

F I
G 0 1 N 23/04
B 6 1 B 13/00

技術表示箇所
Z

審査請求 未請求 請求項の数16 O.L (全9頁)

(21)出願番号 特願平7-69129
(22)出願日 平成7年(1995)3月28日

(71)出願人 000005108
株式会社日立製作所
東京都千代田区神田駿河台四丁目6番地
(72)発明者 伊東 新一
茨城県日立市幸町三丁目1番1号 株式会
社日立製作所日立工場内
(74)代理人 弁理士 小川 勝男

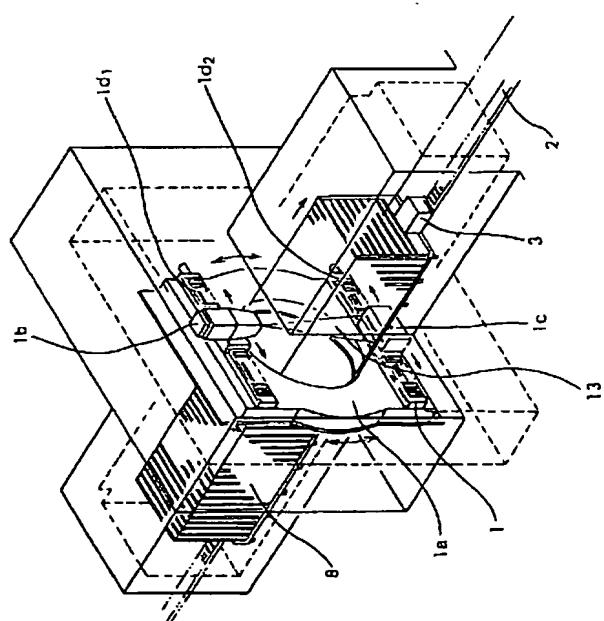
(54)【発明の名称】 コンテナ用X線CT検査設備、及びコンテナ用X線CT検査方法

(57)【要約】

【目的】本発明の目的は、コンテナそのものをX線CT検査するだけで、コンテナに収納されている貨物内部の状態(相対密度、構造)を正確に画像化して表示することができるコンテナ用X線CT検査設備を提供するにある。

【構成】本発明では上記目的を達成するために、検査対象物であるコンテナ8を内部に搬入する搬入口4と検査後のコンテナ8を外部に搬出する搬出口5が設けられている検査建屋棟6と、該検査建屋棟6に設けられているX線CT検査装置1と、コンテナ8を前記検査建屋棟6内に搬入してX線CT検査装置1が位置する所まで導き、検査した後、コンテナ8を検査建屋棟6外に導き搬送するために布設されているコンテナ搬送用レール2とを備えているコンテナ用X線CT検査設備としたことを特徴とする。

図 1



【特許請求の範囲】

【請求項1】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するために布設されているコンテナ搬送用レールとを備えていることを特徴とするコンテナ用X線CT検査設備。

【請求項2】前記検査建屋棟の搬入口側に布設されているコンテナ搬送用レールは、検査前コンテナの集積ヤードまで布設され、一方、検査建屋棟の搬出口側に布設されているコンテナ搬送用レールは、検査後コンテナの集積ヤードまで布設されていることを特徴とする請求項1記載のコンテナ用X線CT検査設備。

【請求項3】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するために布設されているコンテナ搬送用レールとを備え、

前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤からなり、該回転テーブル盤の中空部に前記コンテナが位置した時点に前記X線源装置からX線ビームをコンテナに照射して内部の貨物をCT検査することを特徴とするコンテナ用X線CT検査設備。

【請求項4】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するために布設されているコンテナ搬送用レールとを備え、

前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤が、前記検査建屋棟の床面に対して垂直に配置されて検査建屋棟の支持架台用壁面に回転可能に設置されてなり、かつ、前記回転テーブル盤の中空部には、前記コンテナの搬入口から搬出口まで布設されている前記コンテナ搬送用レールが水平に配置されていることを特徴とするコンテナ用X線CT検査設備。

【請求項5】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟のほぼ中央部で四方に突出している支持架台用壁の内部側面に設けられているX線CT検査装置と、コンテナを前記検査建

10

屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するために布設されているコンテナ搬送用レールとを備え、

前記検査建屋棟のほぼ中央部で下方に突出している部分は、地上より所定の深さに掘って形成されているピットであることを特徴とするコンテナ用X線CT検査設備。

20

【請求項6】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するために布設されているコンテナ搬送用レールとを備え、

前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤が、前記検査建屋棟の床面に対して垂直に配置されて検査建屋棟の支持架台用壁面に回転可能に設置されてなり、かつ、該回転テーブル盤が回転できるように該回転テーブル盤が位置する前記検査建屋棟のほぼ中央部で四方に突出していると共に、そのうちの検査建屋棟の下方に突出している部分は、地上より所定の深さに掘って形成されているピットであることを特徴とするコンテナ用X線CT検査設備。

30

【請求項7】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するために布設されているコンテナ搬送用レールとを備え、

前記X線CT検査装置は、X線ビームを照射するX線源装置と、該X線源装置から照射されるX線ビームを受ける検出器装置と、該検出器装置とX線源装置をそれぞれ並進移動させる並進移動装置と、これらX線源装置の並進移動装置と検出器装置の並進移動装置とが中空部を挟んで対向配置されている中空の回転テーブル盤からなり、前記回転テーブル盤の中空部に前記コンテナが位置した時点に前記X線源装置からX線ビームをコンテナに照射し、これを前記検出器装置で受けながら前記並進移動装置に沿って前記X線源装置と検出器装置が並行移動することを特徴とするコンテナ用X線CT検査設備。

40

【請求項8】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送す

50

るためには布設されているコンテナ搬送用レールとを備え、

前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤からなり、該回転テーブル盤の2つを前記検査建屋棟の床面に対して垂直に、かつ、両者が180°対称に配置されるように検査建屋棟の天井部と床部の同一面内に設けた支持架台壁面に背中合わせに設置されていることを特徴とするコンテナ用X線CT検査設備。

【請求項9】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に搬入された前記コンテナを検査するX線CT検査装置と、該X線CT検査装置を搭載した移動架台と、前記コンテナを搬送するレール付架台とを備えている特徴とするコンテナ用X線CT検査設備。

【請求項10】検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に搬入された前記コンテナを検査するX線CT検査装置と、該X線CT検査装置を搭載した移動架台と、前記コンテナを搬送するレール付架台とを備え、

前記移動架台は、移動装置部と中空部が設けられている垂直架台とから構成され、該垂直架台の側面に前記X線CT検査装置を設置すると共に、前記レール付架台は、前記垂直架台と中空の回転テーブル盤の中空部を経由して配置されていることを特徴とするコンテナ用X線CT検査設備。

【請求項11】検出器装置とX線源装置を搭載した中空の回転テーブル盤を、移動架台上に垂直に設けられた中空の垂直架台側面に設け、かつ、コンテナ搬入口側から前記中空の垂直架台と中空の回転テーブル盤の中空部を経由してコンテナ搬出口側まで水平に配置されたコンテナ搬送用レール付架台を備えていることを特徴とするコンテナ用X線CT検査設備。

【請求項12】検出器装置とX線源装置を搭載した中空の回転テーブル盤を2つ、移動架台上に垂直に設けられた中空の垂直架台の両側面に180°対称に設け、かつ、コンテナ搬入口側から前記中空の垂直架台と中空の回転テーブル盤の中空部を経由してコンテナ搬出口側まで水平に配置されたコンテナ搬送用レール付架台を備えていることを特徴とするコンテナ用X線CT検査設備。

【請求項13】コンテナをコンテナ搬入口より検査建屋棟内に導いてX線CT検査装置の付近まで搬送し、該コンテナの先端が前記X線CT検査装置の位置に達したら搬送台車を一旦停止させ、停止した位置で前記X線CT検査装置の加速器装置は並進移動装置に沿って、検出器装置は並進移動装置に沿って両者が並行移動しながら加速器装置からX線ビームを照射してコンテナの内部をCT撮影し、コンテナに収納されている貨物内部の状態を表示する特徴とするコンテナ用X線CT検査方法。

表示することを特徴とするコンテナ用X線CT検査方法。

【請求項14】集積ヤードに集積されている検査前のコンテナを搬送台車に積載し、その後、この搬送台車を搬送レール上に沿って搬送してコンテナ搬入口より検査建屋棟内に導いてX線CT検査装置の付近まで搬送し、コンテナの先端が前記X線CT検査装置の位置に達したら搬送台車を一旦停止させ、停止した位置でX線CT検査装置の加速器装置は並進移動装置に沿って、検出器装置は並進移動装置に沿って両者が並行移動しながら加速器装置からX線ビームを照射してコンテナの内部をCT撮影し、コンテナに収納されている貨物内部の状態を表示し、次に、コンテナの停止した同じ位置でX線CT検査装置の回転テーブルを所定角度回転させ、この位置で上記と同様なX線CT検査装置での検査を行い、この検査手順を回転テーブルを所定角度回転させながら次々に180°X線CT検査装置を回転させて行うことを特徴とするコンテナ用X線CT検査方法。

【請求項15】集積ヤードからの検査前のコンテナを搬送台車によりコンテナ搬入口から検査建屋棟内に搬送し、搬送してきたコンテナの先端部を中空の第1の回転テーブルの加速器装置から照射されるX線ビームの位置に置くと共に、中空の第2の回転テーブルの加速器装置からのX線ビームの照射位置をコンテナのほぼ中央部に位置させ、この状態から各加速器装置からX線ビームを照射し、前記第1の回転テーブルの加速器装置からのX線ビームによるコンテナの検査は、コンテナの先端からほぼ真中まで行い、これと同時に行われている第2の回転テーブルの加速器装置からのX線ビームによるコンテナの検査は、コンテナのほぼ真中から終端まで行うことを特徴とするコンテナ用X線CT検査方法。

【請求項16】コンテナをレール付架台の所定の位置に設定し、X線CT検査装置の加速器装置から照射されるX線ビーム照射位置を前記コンテナの端部に合わせ、その後、前記X線CT検査装置の加速器装置は並進移動装置に沿って、検出器装置は並進移動装置に沿って両者が並行移動しながら加速器装置からX線ビームを照射してコンテナの内部をCT撮影し、コンテナに収納されている貨物内部の状態を表示してCT検査を行う際に、そのCT検査の開始と共に前記X線CT検査装置を搭載している移動架台をコンテナの終端部まで移動させて検査を行うことを特徴とするコンテナ用X線CT検査方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明はコンテナ用X線CT検査設備に係り、特に、コンテナ内の貨物を、コンテナ内に入れたままの状態でX線を用いてCT検査を行うものに好適なコンテナ用X線CT検査設備に関する。

【0002】

【従来の技術】近年、コンテナ内に収納されてくる輸入

品の貨物の中に銃器、麻薬、大麻等が一緒に隠されていることが多くなり、空港、港湾等におけるこれらの貨物の検査が重要になってきている。特に、麻薬の場合は、他の粉末品と混合されていることもあり、その区別がなかなかできづらくなっている。

【0003】従来からこれらの検査を行う方式は種々あるが（人間のカンに頼る方式、金属探知方式、或いはX線透過撮影方式等）、最近、高エネルギー（6～8MeV）X線を使用するX線透過撮影方式によりコンテナをそのまま撮影し、その内部に隠された不審物を検査する設備が使用されはじめてきている。

【0004】

【発明が解決しようとする課題】しかしながら、このX線透過撮影方式は、その適用範囲に次のような問題がある。即ち、

（1）高エネルギーX線の透過力が大き過ぎるため、低密度材から構成される貨物に対しては、その内容物の形態を透過像から理解することは難しく、主として金属製品（例えば、銃器等）の有無の識別に限られてしまう。

【0005】（2）金属厚板材の容器に低密度材を充填している場合も、X線は金属材の影響を受けるため、低密度材の有無について識別することは困難である。

【0006】（3）様々な種類の高、及び低密度材から構成される貨物の場合も同様に識別は難しい。

【0007】その結果、コンテナをそのままX線透過検査する方式は、検査の効率性の点で有効ではあるが、低密度材を含む貨物の内容物に関する妥当な判断ができる十分な情報が得られない。

【0008】特に、最近、危機管理の面で貨物の内容物を詳細に識別する必要性が急激に増加しているため、上述の（1）、（2）、（3）に対する有効性が実証されているX線断層撮影方式（X線CT）の適用が考えられはじめた。

【0009】ところが、現在のところ、コンテナ専用のX線CT検査設備はない。従って、コンテナからその貨物を外に取り出さずに、かつ、その貨物内部の材質密度、及び形状を正確に把握できるコンテナ用X線CT検査設備の必要性が非常に高くなっている。

【0010】本発明は上述の点に鑑みなされたもので、その目的とするところは、コンテナそのものをX線CT検査するだけで、コンテナに収納されている貨物内部の状態（相対密度、構造）を正確に画像化して表示することができるコンテナ用X線CT検査設備、及びコンテナ用X線CT検査方法を提供するにある。

【0011】

【課題を解決するための手段】本発明は上記目的を達成するために、検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟

内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するため布設されているコンテナ搬送用レールとを備えているコンテナ用X線CT検査設備、前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤からなり、該回転テーブル盤の中空部に前記コンテナが位置した時点に前記X線源装置からX線ビームをコンテナに照射して内部の貨物をCT検査するコンテナ用X線CT検査設備、前記X線CT検査装置は、X線ビームを照射するX線源装置と、該X線源装置から照射されるX線ビームを受ける検出器装置と、該検出器装置とX線源装置をそれぞれ並進移動させる並進移動装置と、これらX線源装置の並進移動装置と検出器装置の並進移動装置とが中空部を挟んで対向配置されている中空の回転テーブル盤とからなり、前記回転テーブル盤の中空部に前記コンテナが位置した時点に前記X線源装置からX線ビームをコンテナに照射し、これを前記検出器装置で受けながら前記並進移動装置に沿って前記X線源装置と検出器装置が並行移動する20コンテナ用X線CT検査設備、前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤からなり、該回転テーブル盤の2つを前記検査建屋棟の床面に対して垂直に、かつ、両者が180°対称に配置されるように検査建屋棟の天井部と床部の同一面内に設けた支持架台壁面に背中合わせに設置されているコンテナ用X線CT検査設備、検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に搬入された前記コンテナを検査するX線CT検査装置と、該X線CT検査装置を搭載した移動架台と、前記コンテナを搬送するレール付架台とを備えているコンテナ用X線CT検査設備、前記移動架台は、移動装置部と中空部が設けられている垂直架台とから構成され、該垂直架台の側面に前記X線CT検査装置を設置すると共に、前記レール付架台は、前記垂直架台と中空の回転テーブル盤の中空部を経由して配置されているコンテナ用X線CT検査設備、コンテナをコンテナ搬入口より検査建屋棟内に導いてX線CT検査装置の付近まで搬送し、該コンテナの先端が前記X線CT検査装置の位置に達したら搬送台車を一旦停止させ、停止した位置で前記X線CT検査装置の加速器装置は並進移動装置に沿って、検出器装置は並進移動装置に沿って両者が並行移動しながら加速器装置からX線ビームを照射してコンテナの内部をCT撮影し、コンテナに収納されている貨物内部の状態を表示するコンテナ用X線CT検査方法、これを、コンテナの停止した同じ位置でX線CT検査装置の回転テーブルを所定角度回転させ、この位置で上記と同様なX線CT検査装置での検査を行い、この検査手順を回転テーブルを所定角度回転させながら次々に180°X線CT検査装置を回転させて304050

行うコンテナ用X線CT検査方法、集積ヤードからの検査前のコンテナを搬送台車によりコンテナ搬入口から検査建屋棟内に搬送し、搬送されてきたコンテナの先端部を中空の第1の回転テーブルの加速器装置から照射されるX線ビームの位置に置くと共に、中空の第2の回転テーブルの加速器装置からのX線ビームの照射位置をコンテナのほぼ中央部に位置させ、この状態から各加速器装置からX線ビームを照射し、前記第1の回転テーブルの加速器装置からのX線ビームによるコンテナの検査は、コンテナの先端からほぼ真中まで行い、これと同時に行われている第2の回転テーブルの加速器装置からのX線ビームによるコンテナの検査は、コンテナのほぼ真中から終端まで行うコンテナ用X線CT検査方法、としたことを特徴とする。

【0012】

【作用】本発明の構成とすることにより、コンテナ自体をそのままCT検査することができ、かつ、コンテナ内に収納されている貨物内部の状態（相対密度、構造）を正確に判別できるので上記の目的が達成される。

【0013】

【実施例】以下、図示した実施例に基づいて本発明のコンテナ用X線CT検査設備を説明する。

【0014】図1、及び図2に本発明のコンテナ用X線CT検査設備の一実施例を示す。図1に示すごとく、本実施例のコンテナ用X線CT検査設備は、検査建屋棟6と、この検査建屋棟6のほぼ中央部で四方に突出しているコンクリート製の支持架台壁7の内部側面に設けられているX線CT検査装置1と、検査対象物であるコンテナ8を検査建屋棟6内に搬送してX線CT検査装置1が位置する所まで導き、検査した後、コンテナ8を検査建屋棟6外に導き搬送するために布設されているコンテナ搬送用レール2と、このコンテナ搬送用レール2上を移動させ、コンテナ8を載置して搬送する搬送台車3とから概略構成されている。

【0015】なお、検査建屋棟6には、コンテナ搬入口4とコンテナ搬出口5が設けられており、また、検査建屋棟6のほぼ中央部で四方に突出しているコンクリート製の支持架台壁7の底部、つまり、検査建屋棟6のほぼ中央部のコンテナ搬送用レール2の下の部分は、地上より所定の深さに掘ってピットを作り、X線CT検査装置1が検査対象物であるコンテナ8を中心にして回転できるようになっている。図2に上記したX線CT検査装置1の概略構成を示す。該図の如く、X線CT検査装置1は、中空の回転テーブル1a、加速器装置1b、検出器装置1c、並進移動装置1d₁、1d₂から構成されている。そして、中空の回転テーブル1aは、検査建屋棟6のコンクリート製の支持架台壁7の内部側面に沿って垂直に回転可能に設置され、しかも、この回転テーブル1aの中空部の下部にはコンテナ搬送用レール2が布設されている。

【0016】一方、加速器装置1bは並進移動装置1d₁に、検出器装置1cは並進移動装置1d₂にそれぞれ固定され、そして、これら並進移動装置1d₁、1d₂は、中空の回転テーブル1aの中空部を挟んで並行に配置されて、回転テーブル1aの中空部にあるコンテナ8に加速器装置1bからのX線ビーム13を照射し、これを検出器装置1cが受けながら、並進移動装置1d₁、1d₂に沿って、加速器装置1bと検出器装置1cが移動するようになっている。

10 【0017】また、コンテナ搬送用レール2は、検査建屋棟6のコンテナ搬入口4から中空の回転テーブル1aの中空部を経由してコンテナ搬出口5まで布設され、そのコンテナ搬送用レール2上を搬送台車3に積載されたコンテナ8がCT撮影の進行に応じて移動するものである。

【0018】図3に、本実施例におけるX線CT検査を効率的に行うためのX線CT検査設備とコンテナ8の集積ヤード9との配置関係を示す。

【0019】該図に示すごとく、検査前のコンテナ8が集積されている集積ヤード9から検査建屋棟6のコンテナ搬入口4まで布設されている搬送レール10a、及びコンテナ搬出口5から検査後のコンテナ8を集積ヤード11まで搬送するために布設されている搬送レール10bがあり、更に、検査後のコンテナ8を集積ヤード11まで搬送した後、何も積載されていない搬送台車3を集積ヤード11から集積ヤード9へ戻す搬送レール10が布設されている。勿論、搬送レール10aと10bは検査建屋棟6の内部に布設されている搬送レール（図示せず）を介して連続的につながっている。

20 30 【0020】次に、本実施例におけるコンテナ8の検査の仕方について図1乃至図3を用いて説明する。

【0021】先ず、集積ヤード9に集積されている検査前のコンテナ8を搬送台車3に積載し、その後、この搬送台車3を搬送レール10a上に沿って搬送してコンテナ搬入口4より検査建屋棟6内に導きX線CT検査装置1の付近まで搬送し、コンテナ8の先端がX線CT検査装置1の位置に達したら搬送台車3を一旦停止させる。

40 【0022】搬送台車3が停止したら検査前の所定の点検をし、その後、コンテナ8を所定距離移動させ停止させる。停止した位置でX線CT検査装置1の加速器装置1bは並進移動装置1d₁に沿って、検出器装置1cは並進移動装置1d₂に沿って両者が並行移動しながら加速器装置1bからX線ビーム13を照射してコンテナ8の内部を撮影し、それを検出器装置1cに入力してSRT（図示せず）に画像化してコンテナ8に収納されている貨物内部の状態（相対密度、構造）を正確に表示する。

【0023】次に、コンテナ8の停止した同じ位置でX線CT検査装置1の回転テーブル1aを所定角度（例えば15°）回転させ、この位置で上記と同様なX線CT

検査装置1での検査を行い、所定角度回転した位置でのコンテナ8に収納されている貨物内部の状態（相対密度、構造）を検査する。そして、この検査手順を回転テーブル1aを所定角度回転させながら次々に180°X線CT検査装置1を回転させて行う（従って、上記の検査を12回行うことになる）。ここまで1回目の停止位置におけるコンテナ8の検査が終了することになる。

【0024】1回目の停止位置におけるコンテナ8の検査が終了したら、次に、コンテナ8を所定距離移動させて上記と同様な検査を行い、これをコンテナ8の全長について行うことにより、コンテナ8に収納されている貨物内部の状態（相対密度、構造）を検査することができる。

【0025】検査が終了したコンテナ8は、検査建屋棟6のコンテナ搬出口5から搬送台車3に積載された状態で搬出され、搬送レール10b上を搬送されて集積ヤード11まで運ばれる。ここで検査済のコンテナ8は、搬送台車3から降ろされて集積ヤード11に集積される一方、搬送台車3は搬送レール10c上を搬送され、検査前のコンテナ8の集積ヤード9まで送られて再度使用されることになる。

【0026】本発明の第2の実施例を図4を用いて説明する。該図に示す実施例は、X線CT検査装置1を2台設置することにより、検査時間を半減させると共に、検査建屋棟6のスペースを小さくすることを目的とするものである。

【0027】即ち、検査建屋棟6のほぼ中央部の突出している部分のコンクリート製の支持架台壁7を内側に突出させ、そのコンクリート製の支持架台壁7の両側面にX線CT検査装置1を180°対称に設けたものである。

【0028】つまり、本実施例の場合は、X線CT検査装置1を構成する2台の中空の回転テーブル1a₁、1a₂が、コンテナ8の長さの約1/2の間隔を離して検査建屋棟6のコンクリート製の支持架台壁7の両側面に180°対称に設けられているものである。2台の中空の回転テーブル1a₁、1a₂のそれぞれに配置される加速器装置1b、検出器装置1c、並進移動装置1d₁、1d₂は、上述した実施例のものと同様なので特に説明はしない。

【0029】次に、本実施例におけるコンテナ8の検査方法について説明する。集積ヤード9からの検査前のコンテナ8は、上述の実施例と同様にして搬送台車3によりコンテナ搬入口4から検査建屋棟6内に搬送される。そして、搬送されてきたコンテナ8の先端部を、中空の回転テーブル1a₁の加速器装置1bから照射されるX線ビーム13の位置に置く。これにより、回転テーブル1a₂の加速器装置1bからのX線ビーム13の照射位置は、コンテナ8のほぼ中央部に位置することになる。

【0030】このような状態から上述した実施例と同様

な方法でコンテナ8の検査を行うことにより、回転テーブル1a₁の加速器装置1bからのX線ビーム13によるコンテナ8の検査は、コンテナ8のほぼ真中で終え、これと同時に行われている回転テーブル1a₂の加速器装置1bからのX線ビーム13によるコンテナ8の検査は、コンテナ8のほぼ真中から終端まで行うことになる。

【0031】このような本実施例とすることにより、上述した実施例と同様な効果が達成できることは勿論、上述した実施例に比較すると、コンテナ8の全長を検査する時間が半減し、尚かつ、検査建屋棟6のスペースも上述した実施例に比べ狭くすることができると言う効果がある。

【0032】本発明の第3の実施例を図5を用いて説明する。本実施例におけるコンテナ用X線CT検査設備は、上述した実施例と同様な構成からなるX線CT検査装置1と、このX線CT検査装置1を搭載した移動架台12と、コンテナ8を搭載するレール付架台14とから構成される。

【0033】移動架台12は、移動装置部12aと中空部を設けた垂直架台12bとから構成され、垂直架台12bの側面にX線CT検査装置1を設置している。一方、レール付架台14は、垂直架台12bと中空の回転テーブル1a₁の中空部を経由して配置され、その支持は本架台の両端部とし、移動架台12の走査スペースを設けている。

【0034】本実施例におけるコンテナ8の検査方法は、先ず最初にコンテナ8をレール付架台14の所定の位置に設定し、加速器装置1bからのX線ビーム13をコンテナ8の端部に合わせ、上述した実施例と同様にしてCT検査を行うが、本実施例では、CT検査の開始と共に移動架台12をコンテナ8の他の端部まで移動させて検査を行うものである。このようにすることにより、走査距離は概略コンテナ8の長さとなるため、第1の実施例に比較すると検査建屋棟6のスペースはほぼ半減することになる。

【0035】本発明の第4の実施例を図6を用いて説明する。該図に示す実施例は、図4に示した実施例の改良であり、移動架台12にX線CT検査装置1を2台搭載した場合である。

【0036】本実施例の場合、2台の中空の回転テーブル1a₁、1a₂はコンテナ8の長さの約1/2の間隔を離して移動架台12の中空の垂直架台12bの両側面に180°対称の配置で固定される。中空の回転テーブル1a₁、1a₂に搭載される各種装置は、前述した実施例と同様である。そして、レール付架台14は、垂直架台12b、中空の回転テーブル1a₁、1a₂を経由して配置される。

【0037】本実施例におけるコンテナ8の検査方法は、図4に示した実施例と概略同様であるが、本実施例

の場合には走査距離がコンテナ8の長さのほぼ半分程度になるため、検査時間は図4の実施例に比べて半減する。

【0038】このように、種々説明してきた本実施例のコンテナ用X線CT検査設備は、コンテナ自体を検査対象にして従来のX線透過撮影方式では実現できないコンテナ収納貨物の内部状態（相対密度分布、構造）を画像化できるので、貨物の内容について正確に識別できると共に、検査効率は従来の貨物を開梱して1個毎検査する場合に比較して格段に向上する。

【0039】特に、冷凍コンテナの場合には、本発明の検査方式によれば、内部の冷凍貨物が外気に曝されることはないと、冷凍貨物の品質に対する影響を受けることが無いので、その効果は著しい。

【0040】

【発明の効果】以上説明した本発明のコンテナ用X線CT検査設備、及びコンテナ用X線CT検査方法によれば、検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に設けられているX線CT検査装置と、コンテナを前記検査建屋棟内に搬送して前記X線CT検査装置が位置する所まで導き、検査した後、コンテナを検査建屋棟外に導き搬送するために布設されているコンテナ搬送用レールとを備えているコンテナ用X線CT検査設備、前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤からなり、該回転テーブル盤の中空部に前記コンテナが位置した時点に前記X線源装置からX線ビームをコンテナに照射して内部の貨物をCT検査するコンテナ用X線CT検査設備、前記X線CT検査装置は、X線ビームを照射するX線源装置と、該X線源装置から照射されるX線ビームを受ける検出器装置と、該検出器装置とX線源装置をそれぞれ並進移動させる並進移動装置と、これらX線源装置の並進移動装置と検出器装置の並進移動装置とが中空部を挟んで対向配置されている中空の回転テーブル盤からなり、前記回転テーブル盤の中空部に前記コンテナが位置した時点に前記X線源装置からX線ビームをコンテナに照射し、これを前記検出器装置で受けながら前記並進移動装置に沿って前記X線源装置と検出器装置が並行移動するコンテナ用X線CT検査設備、前記X線CT検査装置は、X線源装置と検出器装置とが対向配置されて搭載されている中空の回転テーブル盤からなり、該回転テーブル盤の2つを前記検査建屋棟の床面に対して垂直に、かつ、両者が180°対称に配置されるように検査建屋棟の天井部と床部の同一面内に設けた支持架台壁面に背中合わせに設置されているコンテナ用X線CT検査設備、検査対象物であるコンテナを内部に搬入する搬入口と検査後のコンテナを外部に搬出する搬出口が設けられている検査建屋棟と、該検査建屋棟に搬入された前記コンテナを検査す

るX線CT検査装置と、該X線CT検査装置を搭載した移動架台と、前記コンテナを搬送するレール付架台とを備えているコンテナ用X線CT検査設備、前記移動架台は、移動装置部と中空部が設けられている垂直架台とから構成され、該垂直架台の側面に前記X線CT検査装置を設置すると共に、前記レール付架台は、前記垂直架台と中空の回転テーブル盤の中空部を経由して配置されているコンテナ用X線CT検査設備、コンテナをコンテナ搬入口より検査建屋棟内に導いてX線CT検査装置の付近まで搬送し、該コンテナの先端が前記X線CT検査装置の位置に達したら搬送台車を一旦停止させ、停止した位置で前記X線CT検査装置の加速器装置は並進移動装置に沿って、検出器装置は並進移動装置に沿って両者が並行移動しながら加速器装置からX線ビームを照射してコンテナの内部をCT撮影し、コンテナに収納されている貨物内部の状態を表示するコンテナ用X線CT検査方法、これを、コンテナの停止した同じ位置でX線CT検査装置の回転テーブルを所定角度回転させ、この位置で上記と同様なX線CT検査装置での検査を行い、この検査手順を回転テーブルを所定角度回転しながら次々に180°X線CT検査装置を回転させて行うコンテナ用X線CT検査方法、集積ヤードからの検査前のコンテナを搬送台車によりコンテナ搬入口から検査建屋棟内に搬送し、搬送してきたコンテナの先端部を中空の第1の回転テーブルの加速器装置から照射されるX線ビームの位置に置くと共に、中空の第2の回転テーブルの加速器装置からのX線ビームの照射位置をコンテナのほぼ中央部に位置させ、この状態から各加速器装置からX線ビームを照射し、前記第1の回転テーブルの加速器装置からのX線ビームによるコンテナの検査は、コンテナの先端からほぼ真中まで行い、これと同時に行われている第2の回転テーブルの加速器装置からのX線ビームによるコンテナの検査は、コンテナのほぼ真中から終端まで行うコンテナ用X線CT検査方法としたものであるから、コンテナ自体をそのままCT検査することができ、かつ、コンテナ内に収納されている貨物内部の状態（相対密度、構造）を正確に判別できるので、コンテナそのものをX線CT検査するだけで、コンテナに収納されている貨物内部の状態を正確に画像化して表示することができるとする効果を有する。

【図面の簡単な説明】

【図1】本発明のコンテナ用X線CT検査設備の一実施例を示す斜視図である。

【図2】図1の縦断面図である。

【図3】本発明のコンテナ用X線CT検査設備と集積ヤードとの配置関係を示す図である。

【図4】本発明のコンテナ用X線CT検査設備の第2の実施例を示す縦断面図である。

【図5】本発明のコンテナ用X線CT検査設備の第3の実施例を示す縦断面図である。

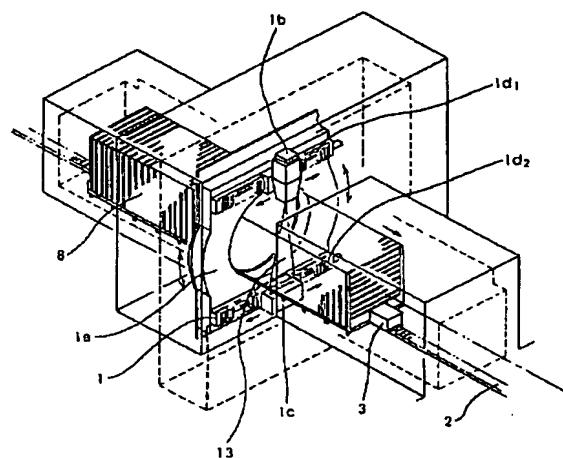
【図6】本発明のコンテナ用X線CT検査設備の第3の実施例を示す縦断面図である。

【符号の説明】

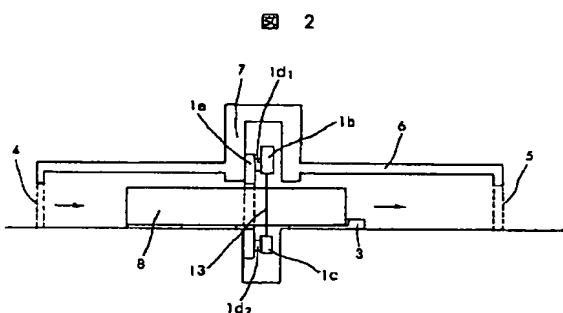
1…X線CT検査装置、1a, 1a₁, 1a₂…回転テーブル、1b…加速器装置、1c…検出器装置、1d₁, 1d₂…並進移動装置、2…コンテナ搬送用レール、3…*

*…搬送台車、4…コンテナ搬入口、5…コンテナ搬出
口、6…検査建屋棟、7…支持架台壁、8…コンテナ、
9, 11…集積ヤード、10a, 10b, 10c…搬送
レール、12…移動架台、12b…垂直架台、13…X
線ビーム、14…レール付架台。

【図1】

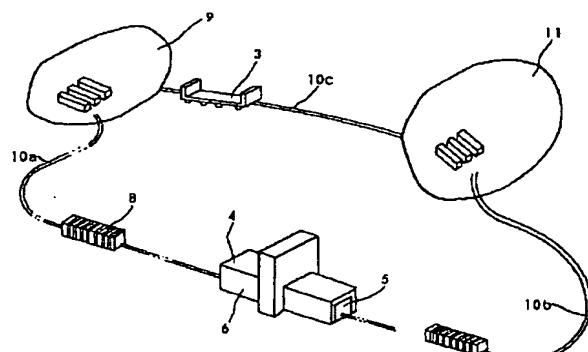


【図2】

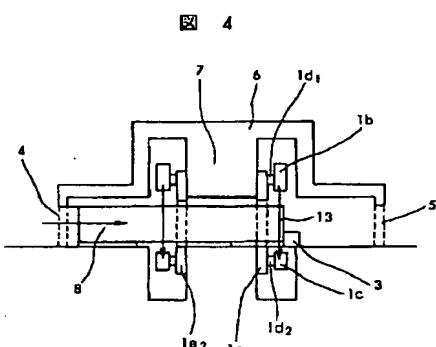


【図3】

図3

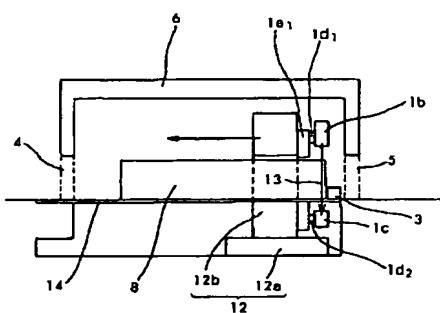


【図4】



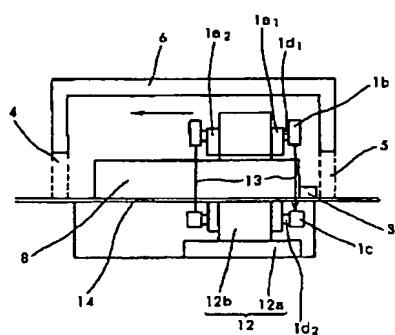
【図5】

図5



【図6】

图 6



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-261958
 (43)Date of publication of application : 11.10.1996

(51)Int.Cl. G01N 23/04
 B61B 13/00

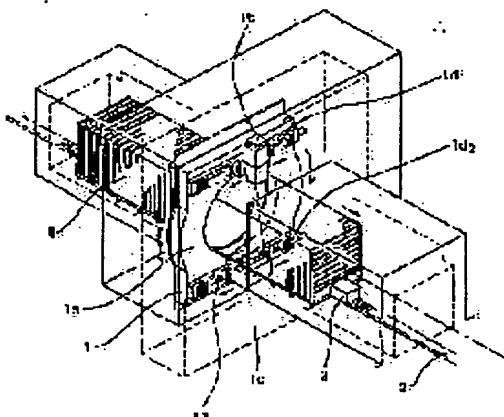
(21)Application number : 07-069129 (71)Applicant : HITACHI LTD
 (22)Date of filing : 28.03.1995 (72)Inventor : ITO SHINICHI

(54) X-RAY CT INSPECTION FACILITY FOR CONTAINER AND METHOD THEREOF

(57)Abstract:

PURPOSE: To provide an X-ray CT inspection facility for a container capable of accurately forming the state (relative density and structure) in a cargo stored in the container and displaying it by merely applying an X-ray CT inspection to the container.

CONSTITUTION: This X-ray CT inspection facility for a container is provided with an inspection building ridge 6 having a carry-in port 4 for carrying-in the container 8 to be inspected and a carry-out port, 5 for carrying-out the container 8, an X-ray CT inspection device 1 provided in the inspection building ridge 6, and a container conveying rail 2 installed for conveying the container 8 into the inspection building ridge 6, guiding it to the position of the X-ray CT inspection device 1, and conveying it to the outside of the inspection building ridge after an inspection.



LEGAL STATUS

[Date of request for examination] 16.09.1999

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number] 3269319

[Date of registration] 18.01.2002

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

X-RAY CT INSPECTION FACILITY FOR CONTAINER AND METHOD THEREOF

[Claim(s)]

[Claim 1] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. The X-ray CT inspection facility for containers characterized by having the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it after inspecting.

[Claim 2] It is the X-ray CT inspection facility for containers according to claim 1 characterized by laying the rail for container conveyance laid at the carrying-in opening side of said inspection building building to the accumulation yard of the container before inspection, and laying the rail for container conveyance laid on the other hand at the taking-out opening side of an inspection building building to the accumulation yard of the container after inspection.

[Claim 3] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. After inspecting, it has the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it. Said X-ray CT test equipment It consists of the rotary table board of the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried. The X-ray CT inspection facility for containers characterized by irradiating an X-ray beam from said X-ray source assembly at a container, and carrying out CT inspection of the internal cargo when said container is located in the centrum of this rotary table board.

[Claim 4] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. After inspecting, it has the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it. Said X-ray CT test equipment The rotary table board of the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried It is perpendicularly arranged to the floor line of said inspection building building, and it is installed in the wall surface for support stands of an inspection building building pivotable, and becomes it. To the centrum of said rotary table board The X-ray CT inspection facility for containers characterized by arranging horizontally said rail for container conveyance with which even taking-out opening is laid from carrying-in opening of said container.

[Claim 5] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, The X-ray CT test equipment prepared in the internal side face of the wall for support stands of this inspection building building mostly projected on all sides in the center section, It leads to the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. After

inspecting, it has the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it. The part of said inspection building building mostly projected caudad in the center section The X-ray CT inspection facility for containers characterized by being the pit currently dug and formed in the predetermined depth from the ground.

[Claim 6] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. After inspecting, it has the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it. Said X-ray CT test equipment The rotary table board of the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried It is perpendicularly arranged to the floor line of said inspection building building, and comes to be installed in the wall surface for support stands of an inspection building building pivotable. and said inspection building building in which this rotary table board is located so that this rotary table board can rotate, while having projected on all sides in the center section mostly The part projected down the inspection building building of them is an X-ray CT inspection facility for containers characterized by being the pit currently dug and formed in the predetermined depth from the ground.

[Claim 7] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. After inspecting, it has the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it. Said X-ray CT test equipment The X-ray source assembly which irradiates an X-ray beam, and the detector equipment which receives the X-ray beam irradiated from this X-ray source assembly, The advancing-side-by-side migration equipment which carries out advancing-side-by-side migration of this detector equipment and the X-ray source assembly, respectively, The advancing-side-by-side migration equipment of these X-ray source assemblies and the advancing-side-by-side migration equipment of detector equipment consist of the rotary table board of the hollow by which opposite arrangement is carried out on both sides of the centrum. When said container is located in the centrum of said rotary table board, an X-ray beam is irradiated from said X-ray source assembly at a container. The X-ray CT inspection facility for containers characterized by said X-ray source assembly and detector equipment carrying out concurrency migration along with said advancing-side-by-side migration equipment while said detector equipment receives this.

[Claim 8] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. After inspecting, it has the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it. Said X-ray CT test equipment It consists of the rotary table board of

the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried. The X-ray CT inspection facility for containers characterized by being installed back to back by the support stand wall surface which prepared two of these rotary table boards in the same side of the head-lining section of an inspection building building, and a floor to the floor line of said inspection building building so that both might be stationed perpendicularly at 180-degree symmetry.

[Claim 9] The X-ray-CT inspection facility for containers by which it is characterized [equipped with the inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, the X-ray-CT test equipment which inspect said container carried in to this inspection building building, the migration stand carrying this X-ray-CT test equipment, and the stand with a rail which convey said container].

[Claim 10] The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, The X-ray CT test equipment which inspects said container carried in to this inspection building building, It has a migration stand carrying this X-ray CT test equipment, and the stand with a rail which conveys said container. Said migration stand While consisting of perpendicular stands with which the migration equipment section and a centrum are prepared and installing said X-ray CT test equipment in the side face of this perpendicular stand, said stand with a rail The X-ray CT inspection facility for containers characterized by being arranged via the centrum of the rotary table board of said perpendicular stand and hollow.

[Claim 11] The X-ray CT inspection facility for containers which prepares the rotary table board of the hollow which carried detector equipment and an X-ray source assembly in the perpendicular stand side face in the air which was able to be established perpendicularly on a migration stand, and is characterized by having the perpendicular stand of said hollow, and the stand with a rail for container conveyance arranged at a horizontal via the centrum of the rotary table board in the air at the container taking-out opening side from a container carrying-in opening side.

[Claim 12] The X-ray-CT inspection facility for containers which prepares in the both-sides side of the perpendicular stand of the hollow which was able to prepare perpendicularly on two and a migration stand the rotary table board of the hollow which carried detector equipment and an X-ray source assembly at 180 degree symmetry, and is characterized by to have the perpendicular stand of said hollow, and the stand with a rail for container conveyance arranged at a horizontal via the centrum of the rotary table board in the air at the container taking-out opening side from a container carrying-in opening side.

[Claim 13] From container carrying-in opening, lead a container in an inspection building building and it is conveyed to near X-ray CT test equipment. A conveyance truck is made to suspend when the tip of this container arrives at the location of said X-ray CT test equipment. The accelerator equipment of said X-ray CT test equipment meets advancing-side-by-side migration equipment in the stopped location. Detector equipment is the X-ray CT inspection approach for containers which irradiates an X-ray beam from accelerator equipment, carries out CT photography of the interior of a container while both do concurrency migration along with advancing-side-by-side migration equipment, and is characterized by displaying the condition inside the cargo contained by the container.

[Claim 14] The container before inspection accumulated on the accumulation yard is loaded into a conveyance truck. Then, convey this conveyance truck along a conveyance rail top, and from container carrying-in opening, lead in an inspection building building and it conveys to near X-ray CT test equipment. A conveyance truck is made to suspend when the tip of a container arrives at the location of said X-ray CT test equipment. The accelerator equipment of X-ray CT test equipment meets advancing-side-by-side migration equipment in the stopped location. While both do concurrency migration along with advancing-side-by-side migration equipment, detector equipment irradiates an X-ray beam from accelerator equipment, and carries out CT photography of the interior of a container. Predetermined include-angle rotation of the rotary table of X-ray CT test equipment is carried out in the same location which displayed the condition inside the cargo contained by the container, next the container stopped. The X-ray CT inspection approach for containers characterized by conducting inspection with the same X-ray CT test equipment as the above in this location, and carrying out by rotating 180-degree X-ray CT test equipment one after another, carrying out predetermined include-angle rotation of the rotary table for this inspection routine.

[Claim 15] While conveying the container before the inspection from an accumulation yard in an inspection building building from container carrying-in opening with a conveyance truck and putting the point of the conveyed container on the location of the X-ray beam irradiated from the accelerator equipment of the 1st rotary table in the air You make it mostly located in a center section. the exposure location of the X-ray beam from the accelerator equipment of the 2nd rotary table in the air -- a container -- From this condition, irradiate an X-ray beam from each accelerator equipment, and inspection of the container by the X-ray beam from the accelerator equipment of said 1st rotary table Inspection of the container by the X-ray beam from the accelerator equipment of the 2nd rotary table which carries out from the tip of a container to middle mostly, and is performed to this and coincidence is the X-ray CT inspection approach for containers characterized by the thing of a container mostly performed from middle to termination.

[Claim 16] Set a container as the position of a stand with a rail, and the X-ray beam exposure location irradiated from the accelerator equipment of X-ray CT test equipment is doubled with the edge of said container. Then, the accelerator equipment of said X-ray CT test equipment meets advancing-side-by-side migration equipment. While both do concurrency migration along with advancing-side-by-side migration equipment, detector equipment irradiates an X-ray beam from accelerator equipment, and carries out CT photography of the interior of a container. The X-ray CT inspection approach for containers characterized by inspecting with initiation of the CT inspection by moving the migration stand carrying said X-ray CT test equipment to the trailer of a container in case the condition inside the cargo contained by the container is displayed and CT inspection is conducted.

[Detailed Description of the Invention]

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the X-ray CT inspection facility for containers, and relates to the suitable X-ray CT inspection facility for containers for what conducts CT inspection using an X-ray in the condition [having put in the cargo in a container in a container especially].

[0002]

[Description of the Prior Art] Small arms, narcotics, hemp, etc. are hidden more often together in recent years into the cargo of the importation contained in a container, and inspection of these cargoes in an airport, a port, etc. is becoming important. Especially, in the case of narcotics, since it is mixed with other powder articles, it can very much be hard to perform the distinction, and it is becoming.

[0003] Although there are various methods which conduct these inspection from the former, a container is photoed as it is with the radioparency photography methods (the method depending on human being's can, a metal detection method, or radioparency photography method) which use a high energy (6.8MeV) X-ray recently, the facility which inspects the doubtful object hidden in the interior is used, and it is coming for the first time.

[0004]

[Problem(s) to be Solved by the Invention] However, this radioparency photography method has the following problems in that applicability. That is, since the penetrating power of (1) high energy X-ray is too large, to the cargo which consists of low consistency material, it will be difficult to understand the gestalt of the contents from a transmission image, and it will be restricted mainly to discernment of the existence of metal goods (for example, small arms etc.).

[0005] (2) Also when the container of a metal thickness plate is filled up with low consistency material, since an X-ray is influenced of metal material, it is difficult to identify about the existence of low consistency material.

[0006] (3) In the cargo which consists of the quantities and low consistency material of various classes, discernment is difficult similarly.

[0007] Consequently, although the method which carries out the X-ray radiographic inspection of the container as it is is effective in respect of the efficiency of inspection, sufficient information which can perform appropriate decision about the contents of the cargo containing low consistency material is not acquired.

[0008] Since the need of identifying the contents of a cargo in a detail in respect of crisis management especially recently is increasing rapidly, it was able to be begun to consider application of the X-ray computed tomography method (X-ray CT) with which the above-mentioned effectiveness over (1), (2), and (3) is proved.

[0009] However, now, there is no X-ray CT inspection facility only for containers. Therefore, the quality of the material consistency inside the cargo and the need for the X-ray CT inspection facility for containers that a configuration can be grasped correctly are becoming very high, without picking out the cargo from a container outside.

[0010] The place which this invention was made in view of the above-mentioned point, and is made into the purpose only carries out X-ray CT inspection of the container itself, and is to offer the X-ray CT inspection facility for containers which images correctly the condition inside the cargo contained by the container (relative density, structure), and can display it, and the X-ray CT inspection approach for containers.

[0011]

[Means for Solving the Problem] The inspection building building in which carrying in opening which carries in to the interior the container which is an inspection object in order that this invention may attain the above-mentioned purpose, and taking out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said

inspection building building, and said X-ray CT test equipment is located. After inspecting, the X-ray CT inspection facility for containers equipped with the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it, and said X-ray CT test equipment It consists of the rotary table board of the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried. The X-ray CT inspection facility for containers which irradiates an X-ray beam from said X-ray source assembly at a container, and carries out CT inspection of the internal cargo when said container is located in the centrum of this rotary table board, The X-ray source assembly with which said X-ray CT test equipment irradiates an X-ray beam, and the detector equipment which receives the X-ray beam irradiated from this X-ray source assembly, The advancing-side-by-side migration equipment which carries out advancing-side-by-side migration of this detector equipment and the X-ray source assembly, respectively, The advancing-side-by-side migration equipment of these X-ray source assemblies and the advancing-side-by-side migration equipment of detector equipment consist of the rotary table board of the hollow by which opposite arrangement is carried out on both sides of the centrum. When said container is located in the centrum of said rotary table board, an X-ray beam is irradiated from said X-ray source assembly at a container. The X-ray CT inspection facility for containers in which said X-ray source assembly and detector equipment carry out concurrency migration along with said advancing-side-by-side migration equipment while said detector equipment receives this, and said X-ray CT test equipment It consists of the rotary table board of the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried. perpendicularly two of these rotary table boards to the floor line of said inspection building building The X-ray CT inspection facility for containers currently installed in the support stand wall surface prepared in the same side of the head-lining section of an inspection building building, and a floor so that both might be stationed at 180-degree symmetry back to back, The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, The X-ray CT test equipment which inspects said container carried in to this inspection building building, The X-ray CT inspection facility for containers equipped with the migration stand carrying this X-ray CT test equipment, and the stand with a rail which conveys said container, and said migration stand While consisting of perpendicular stands with which the migration equipment section and a centrum are prepared and installing said X-ray CT test equipment in the side face of this perpendicular stand, said stand with a rail Said perpendicular stand and the X-ray CT inspection facility for containers arranged via the centrum of the rotary table board in the air, From container carrying-in opening, lead a container in an inspection building building and it is conveyed to near X-ray CT test equipment. A conveyance truck is made to suspend when the tip of this container arrives at the location of said X-ray CT test equipment. The accelerator equipment of said X-ray CT test equipment meets advancing-side-by-side migration equipment in the stopped location. While both do concurrency migration along with advancing-side-by-side migration equipment, detector equipment irradiates an X-ray beam from accelerator equipment, and carries out CT photography of the interior of a container. The X-ray CT inspection approach for containers which displays the condition inside the cargo contained by the container, Predetermined include-angle rotation of the rotary table of X-ray CT test equipment is carried out in the same location where the container stopped this. The X-ray CT inspection approach for

containers which conducts inspection with the same X-ray CT test equipment as the above in this location, and is performed by rotating 180-degree X-ray CT test equipment one after another while carrying out predetermined include angle rotation of the rotary table for this inspection routine, While conveying the container before the inspection from an accumulation yard in an inspection building building from container carrying in opening with a conveyance truck and putting the point of the conveyed container on the location of the X-ray beam irradiated from the accelerator equipment of the 1st rotary table in the air You make it mostly located in a center section. the exposure location of the X-ray beam from the accelerator equipment of the 2nd rotary table in the air -- a container -- From this condition, irradiate an X-ray beam from each accelerator equipment, and inspection of the container by the X-ray beam from the accelerator equipment of said 1st rotary table It is characterized by making inspection of the container by the X-ray beam from the accelerator equipment of the 2nd rotary table which carries out from the tip of a container to middle mostly, and is performed to this and coincidence into the X-ray CT inspection approach for containers of a container mostly performed from middle to termination.

[0012]

[Function] By considering as the configuration of this invention, since the condition inside the cargo which can carry out CT inspection of the container itself as it is, and is contained in the container (relative density, structure) can be distinguished correctly, the above-mentioned purpose is attained.

[0013]

[Example] Hereafter, based on the illustrated example, the X-ray CT inspection facility for containers of this invention is explained.

[0014] One example of the X-ray CT inspection facility for containers of this invention is shown in drawing 1 and drawing 2 . As shown in drawing 1 , the X-ray CT inspection facility for containers of this example The inspection building building 6 and the X-ray CT test equipment 1 prepared in the internal side face of the support stand wall 7 made from concrete of this inspection building building 6 mostly projected on all sides in the center section, The rail 2 for container conveyance laid in order to lead a container 8 outside the inspection building building 6 and to convey it after leading and inspecting to the place in which the container 8 which is an inspection object is conveyed in the inspection building building 6, and X-ray CT test equipment 1 is located, This rail 2 top for container conveyance is moved, and the outline configuration is carried out from the conveyance truck 3 which lays and conveys a container 8.

[0015] In addition, the container carrying-in opening 4 and the container taking-out opening 5 are formed in the inspection building building 6. The pars basilaris ossis occipitalis 6 of the support stand wall 7 made from concrete of the inspection building building 6 mostly projected on all sides in the center section, i.e., an inspection building building, mostly moreover, the part under the rail 2 for container conveyance of a center section From the ground, it digs in the predetermined depth, a pit is made, and X-ray CT test equipment 1 can rotate now centering on the container 8 which is an inspection object. The outline configuration of the X-ray CT test equipment 1 described above to drawing 2 is shown. As shown in this drawing, rotary table 1a in the air, accelerator equipment 1b, detector equipment 1c, and 1d [of advancing-side-by-side migration equipment] 1 or 1d of X-ray CT test equipment 1 consists of 2. And rotary table 1a in the air is perpendicularly installed pivotable along the internal side face of the support stand wall 7 made from the concrete of the inspection building building 6, and, moreover, the rail 2 for

container conveyance is laid by the lower part of the centrum of this rotary table 1a.

[0016] On the other hand, accelerator equipment 1b is 1 1d of advancing-side-by-side migration equipment. Detector equipment 1c is 2 1d of advancing-side-by-side migration equipment. It is fixed, respectively. 1d [of these advancing-side-by-side migration equipment] 1 or 1d 2 While it is arranged in parallel on both sides of the centrum of rotary table 1a in the air, X-ray beam 13 from accelerator equipment 1b is irradiated at the container 8 in the centrum of rotary table 1a and detector equipment 1c receives this Along with 2, accelerator equipment 1b and detector equipment 1c with ad [1 or 1d] of 1d [of advancing-side-by-side migration equipment] move.

[0017] Moreover, even the container taking-out opening 5 is laid via the centrum of rotary table 1a in the air from the container carrying-in opening 4 of the inspection building building 6, and the container 8 loaded into the conveyance truck 3 in the rail 2 top for container conveyance moves the rail 2 for container conveyance according to advance of CT photography.

[0018] The arrangement relation between the X-ray CT inspection facility for performing efficiently X-ray CT inspection in this example to drawing 3 and the accumulation yard 9 of a container 8 is shown.

[0019] Conveyance rail 10a by which even the container carrying-in opening 4 of the inspection building building 6 is laid from the accumulation yard 9 on which the container 8 before inspection is accumulated as shown in this drawing, And there is conveyance rail 10b laid in order to convey the container 8 after inspection from the container taking-out opening 5 to the accumulation yard 11. Furthermore, after conveying the container 8 after inspection to the accumulation yard 11, the conveyance rail 10 which returns the conveyance truck 3 which is not loaded at all to the accumulation yard 9 from the accumulation yard 11 is laid. Of course, the conveyance rails 10a and 10b are continuously connected through the conveyance rail (not shown) laid inside the inspection building building 6.

[0020] Next, the method of inspection of the container 8 in this example is explained using drawing 1 thru/or drawing 3 .

[0021] First, this conveyance truck 3 is conveyed along a conveyance rail 10a top, and when it leads in the inspection building building 6, it conveys to near X-ray CT test equipment 1 and the tip of a container 8 arrives at the location of X-ray CT test equipment 1 from the container carrying-in opening 4, the conveyance truck 3 is made to load into the conveyance truck 3 the container 8 before inspection accumulated on the accumulation yard 9, and to suspend after that.

[0022] If the conveyance truck 3 stops, the predetermined check before inspection will be carried out, after that, predetermined distance migration is carried out and a container 8 is stopped. Accelerator equipment 1b of X-ray CT test equipment 1 meets 1 1d of advancing-side-by-side migration equipment in the stopped location. While both do concurrency migration along with 2 1d of advancing-side-by-side migration equipment, detector equipment 1c irradiates X-ray beam 13 from accelerator equipment 1b, and photos the interior of a container 8. The condition (relative density, structure) inside the cargo which inputs it into detector equipment 1c, images to SRT (not shown), and is contained by the container 8 is displayed correctly.

[0023] Next, the condition (relative density, structure) inside the cargo contained by the container 8 in the location which was made to carry out predetermined include-angle (for example, 15 degrees) rotation of the rotary table 1a of X-ray CT test equipment 1 in the same location which the container 8 stopped, conducted inspection with the same X-ray CT test equipment 1 as the above, and carried out predetermined include-angle rotation in this location is inspected. And it carries out by rotating 180-degree X-ray CT test equipment 1 one after

another, carrying out predetermined include-angle rotation of the rotary table 1a for this inspection routine (therefore, the above-mentioned inspection will be conducted 12 times). Inspection of the container 8 in the 1st halt location will be completed even here.

[0024] If inspection of the container 8 in the 1st halt location is completed next, the condition inside the cargo contained by the container 8 (relative density, structure) can be inspected by carrying out predetermined distance migration of the container 8, conducting the same inspection as the above, and performing this about the overall length of a container 8.

[0025] The container 8 which inspection ended is taken out where the conveyance truck 3 is loaded from the container taking-out opening 5 of the inspection building building 6, it has a conveyance rail 10b top conveyed, and is carried to the accumulation yard 11. While the container [finishing / inspection here] 8 is taken down from the conveyance truck 3 and the accumulation yard 11 is piled up, the conveyance truck 3 will have a conveyance rail 10c top conveyed, will be sent to the accumulation yard 9 of the container 8 before inspection, and will be used again.

[0026] The 2nd example of this invention is explained using drawing 4. The example shown in this drawing aims at making small the tooth space of the inspection building building 6 while it reduces inspection time amount by half by installing two X-ray CT test equipment 1.

[0027] That is, the support stand wall 7 made from the concrete of a part of the inspection building building 6 with which the center section projects mostly is made to project inside, and X-ray CT test equipment 1 is formed in the both-sides side of the support stand wall 7 made from the concrete at 180-degree symmetry.

[0028] the rotary table one a1 of two sets of hollow with which X-ray CT test equipment 1 is constituted in the case of this example and one a2 -- about [of the die length of a container 8] -- one half of spacing is detached and it is prepared in the side face of the support stand wall 7 made from the concrete of the inspection building building 6 at 180-degree symmetry. [that is,] Since 2 [with ad / 1 or 1d / of accelerator equipment 1b arranged at the rotary table one a1 of two sets of hollow and each of one a2, detector equipment 1c, and 1d / of advancing-side-by-side migration equipment] is the same as that of the thing of the example mentioned above, especially explanation is not given.

[0029] Next, the inspection approach of the container 8 in this example is explained. The container 8 before the inspection from the accumulation yard 9 is conveyed in the inspection building building 6 from the container carrying-in opening 4 by the conveyance truck 3 like an above-mentioned example. And it is the rotary table one a1 in the air about the point of the conveyed container 8. It puts on the location of X-ray beam 13 irradiated from accelerator equipment 1b. thereby -- rotary table one a2 the exposure location of X-ray beam 13 from accelerator equipment 1b -- a container 8 -- it will be mostly located in a center section.

[0030] inspecting a container 8 by the same approach as the example mentioned above from such a condition -- rotary table one a1 inspection of the container 8 by X-ray beam 13 from accelerator equipment 1b -- a container 8 -- almost -- middle -- finishing -- this, simultaneously rotary table one a2 currently performed inspection of the container 8 by X-ray beam 13 from accelerator equipment 1b -- a container 8 -- it will carry out from middle to termination mostly.

[0031] the time amount which inspects the overall length of a container 8 as compared with the example mentioned above as well as the ability to attain the same effectiveness as the example mentioned above by considering as such this example -- being halved -- in addition -- and there is effectiveness referred to as being able to narrow compared with the example which also

mentioned above the tooth space of the inspection building building 6.

[0032] The 3rd example of this invention is explained using drawing 5. The X-ray CT inspection facility for containers in this example consists of X-ray CT test equipment 1 which consists of the same configuration as the example mentioned above, a migration stand 12 carrying this X-ray CT test equipment 1, and a stand 14 with a rail carrying a container 8.

[0033] The migration stand 12 consists of migration equipment section 12a and perpendicular stand 12b which prepared the centrum, and is installing X-ray CT test equipment 1 in the side face of perpendicular stand 12b. On the other hand, the stand 14 with a rail is the rotary table one a1 of perpendicular stand 12b and hollow. It has been arranged via a centrum, the support was made into the both ends of this stand, and the scan tooth space of the migration stand 12 is provided.

[0034] Although the inspection approach of the container 8 in this example sets a container 8 as the position of the stand 14 with a rail first, doubles X-ray beam 13 from accelerator equipment 1b with the edge of a container 8 and conducts CT inspection like the example mentioned above, it inspects by moving the migration stand 12 to other edges of a container 8 with initiation of CT inspection in this example. Since scan distance serves as the die length of the outline container 8 by doing in this way, as compared with the 1st example, the tooth space of the inspection building building 6 will be mostly reduced by half.

[0035] The 4th example of this invention is explained using drawing 6. The example shown in this drawing is amelioration of the example shown in drawing 4, and is the case where two X-ray CT test equipment 1 is carried in the migration stand 12.

[0036] the case of this example -- the rotary table one a1 of two sets of hollow, and one a2 -- about [of the die length of a container 8] -- one half of spacing is detached and it is fixed to the both-sides side of perpendicular stand 12b of the hollow of the migration stand 12 by arrangement of 180-degree symmetry. The rotary table one a1 in the air and the various equipments carried in one a2 are the same as that of the example mentioned above. And the stand 14 with a rail is arranged via perpendicular stand 12b, the rotary table one a1 in the air, and one a2.

[0037] Although the inspection approach of the container 8 in this example is the same as that of the example shown in drawing 4, and an outline, since [of the die length of a container 8] it becomes one half extent mostly, in the case of this example, scan distance reduces inspection time amount by half compared with the example of drawing 4.

[0038] thus, since the X-ray CT inspection facility for containers of this example explained variously can image the internal state (relative-density distribution, structure) of a container receipt cargo which makes the container itself a subject of examination and cannot be realized by the conventional radioparency photography method, while it is correctly discriminable about the contents of the cargo, a patient throughput is boiled markedly and it improves as compared with the case where carry out unpacking of the conventional cargo and it is inspected the whole piece.

[0039] Since according to the inspection method of this invention internal frozen cargo is not put to the open air and it is not especially influenced to the quality of frozen cargo in the case of a reefer container, the effectiveness is remarkable.

[0040]

[Effect of the Invention] According to the X-ray CT inspection facility for containers of this invention explained above, and the X-ray CT inspection approach for containers The inspection building building in which carrying in opening which carries in to the interior the container

which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, It leads to the X-ray CT test equipment prepared in this inspection building building, and the place in which a container is conveyed in said inspection building building, and said X-ray CT test equipment is located. After inspecting, the X-ray CT inspection facility for containers equipped with the rail for container conveyance laid in order to lead a container outside an inspection building building and to convey it, and said X-ray CT test equipment It consists of the rotary table board of the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried. The X-ray CT inspection facility for containers which irradiates an X-ray beam from said X-ray source assembly at a container, and carries out CT inspection of the internal cargo when said container is located in the centrum of this rotary table board, The X-ray source assembly with which said X-ray CT test equipment irradiates an X-ray beam, and the detector equipment which receives the X-ray beam irradiated from this X-ray source assembly, The advancing-side-by-side migration equipment which carries out advancing-side-by-side migration of this detector equipment and the X-ray source assembly, respectively, The advancing-side-by-side migration equipment of these X-ray source assemblies and the advancing-side-by-side migration equipment of detector equipment consist of the rotary table board of the hollow by which opposite arrangement is carried out on both sides of the centrum. When said container is located in the centrum of said rotary table board, an X-ray beam is irradiated from said X-ray source assembly at a container. The X-ray CT inspection facility for containers in which said X-ray source assembly and detector equipment carry out concurrency migration along with said advancing-side-by-side migration equipment while said detector equipment receives this, and said X-ray CT test equipment It consists of the rotary table board of the hollow in which opposite arrangement is carried out and an X-ray source assembly and detector equipment are carried. perpendicularly two of these rotary table boards to the floor line of said inspection building building The X-ray CT inspection facility for containers currently installed in the support stand wall surface prepared in the same side of the head-lining section of an inspection building building, and a floor so that both might be stationed at 180-degree symmetry back to back, The inspection building building in which carrying-in opening which carries in to the interior the container which is an inspection object, and taking-out opening which takes out the container after inspection outside are prepared, The X-ray CT test equipment which inspects said container carried in to this inspection building building, The X-ray CT inspection facility for containers equipped with the migration stand carrying this X-ray CT test equipment, and the stand with a rail which conveys said container, and said migration stand While consisting of perpendicular stands with which the migration equipment section and a centrum are prepared and installing said X-ray CT test equipment in the side face of this perpendicular stand, said stand with a rail Said perpendicular stand and the X-ray CT inspection facility for containers arranged via the centrum of the rotary table board in the air, From container carrying-in opening, lead a container in an inspection building building and it is conveyed to near X-ray CT test equipment. A conveyance truck is made to suspend when the tip of this container arrives at the location of said X-ray CT test equipment. The accelerator equipment of said X-ray CT test equipment meets advancing-side-by-side migration equipment in the stopped location. While both do concurrency migration along with advancing-side-by-side migration equipment, detector equipment irradiates an X-ray beam from accelerator equipment, and carries out CT photography of the interior of a container. The X-ray CT inspection approach for containers which displays the condition inside the cargo contained by the container,

Predetermined include-angle rotation of the rotary table of X-ray CT test equipment is carried out in the same location where the container stopped this. The X-ray CT inspection approach for containers which conducts inspection with the same X-ray CT test equipment as the above in this location, and is performed by rotating 180-degree X-ray CT test equipment one after another while carrying out predetermined include-angle rotation of the rotary table for this inspection routine, While conveying the container before the inspection from an accumulation yard in an inspection building building from container carrying-in opening with a conveyance truck and putting the point of the conveyed container on the location of the X-ray beam irradiated from the accelerator equipment of the 1st rotary table in the air You make it mostly located in a center section. the exposure location of the X-ray beam from the accelerator equipment of the 2nd rotary table in the air .. a container .. From this condition, irradiate an X-ray beam from each accelerator equipment, and inspection of the container by the X-ray beam from the accelerator equipment of said 1st rotary table Inspection of the container by the X-ray beam from the accelerator equipment of the 2nd rotary table which carries out from the tip of a container to middle mostly, and is performed to this and coincidence Since it considers as the X-ray CT inspection approach for containers of a container mostly performed from middle to termination Since the condition inside the cargo which can carry out CT inspection of the container itself as it is, and is contained in the container (relative density, structure) can be distinguished correctly It has the effectiveness referred to as imaging correctly the condition inside the cargo contained by the container, and being able to display it only by carrying out X-ray CT inspection of the container itself.

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing one example of the X-ray CT inspection facility for containers of this invention.

[Drawing 2] It is drawing of longitudinal section of drawing 1 .

[Drawing 3] It is drawing showing the arrangement relation of the X-ray CT inspection facility for containers and accumulation yard of this invention.

[Drawing 4] It is drawing of longitudinal section showing the 2nd example of the X-ray CT inspection facility for containers of this invention.

[Drawing 5] It is drawing of longitudinal section showing the 3rd example of the X-ray CT inspection facility for containers of this invention.

[Drawing 6] It is drawing of longitudinal section showing the 3rd example of the X-ray CT inspection facility for containers of this invention.

[Description of Notations]

1 .. X-ray CT test equipment, 1a, one a1, one a2 .. A rotary table, 1b .. Accelerator equipment, 1c .. Detector equipment, 1d1, 1d2 .. Advancing-side-by-side migration equipment, 2 .. The rail for container conveyance, 3 [.. An inspection building building, 7 / .. A support stand wall, 8 / .. 9 A container, 11 / .. An accumulation yard, 10a 10b, 10c / .. A conveyance rail, 12 / .. A migration stand, 12b / .. A perpendicular stand, 13 / .. An X-ray beam, 14 / .. Stand with a rail.] .. A conveyance truck, 4 .. Container carrying-in opening, 5 .. Container taking-out opening, 6

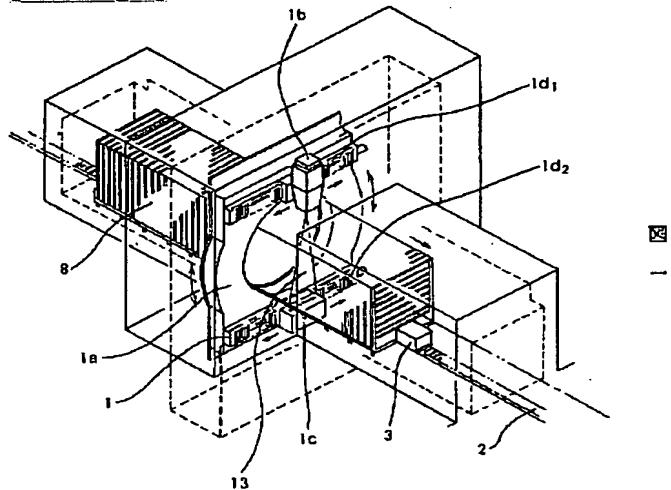
* NOTICES *

JPO and NCIPI are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
3. In the drawings, any words are not translated.

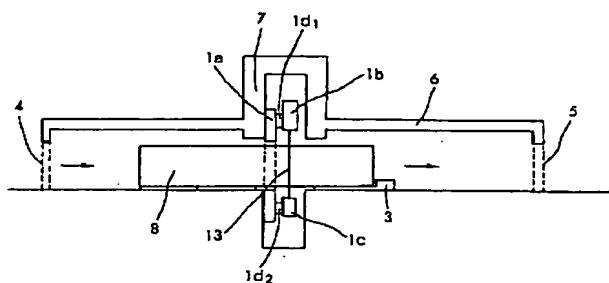
DRAWINGS

[Drawing 1]



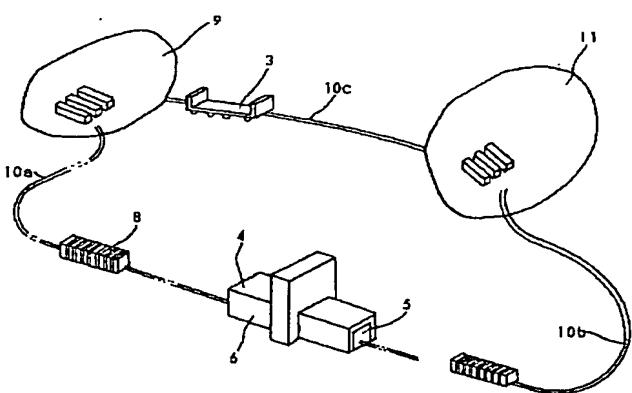
[Drawing 2]

図 2



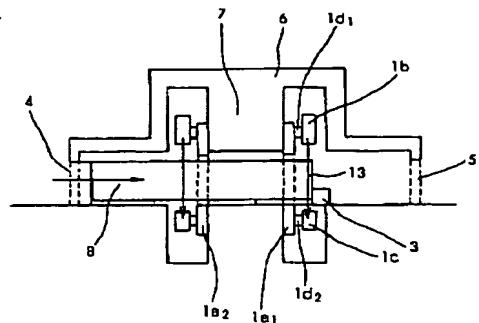
[Drawing 3]

図 3



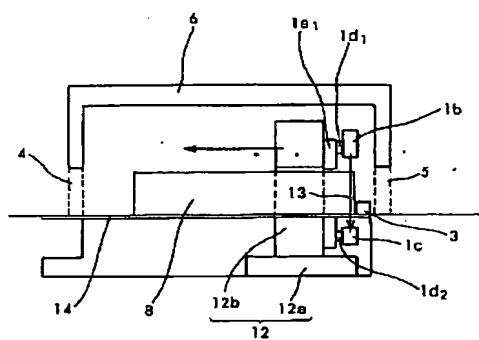
[Drawing 4]

図 4



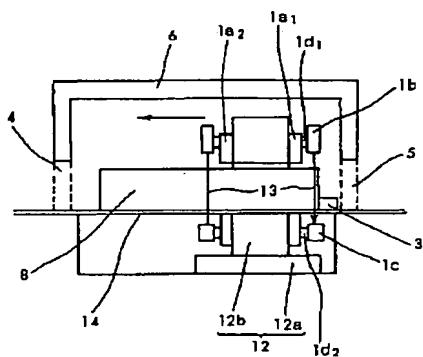
[Drawing 5]

図 5



[Drawing 6]

図 6



[Translation done.]